

#### ABSTRACT OF THE DISCLOSURE

A carbon nanofiber system is synthesized with very high purity (above 95%), selectivity of the carbon morphology, and exceptionally high yield. A custom made catalyst with a particle size of ≤10 nm and a high surface area (>50 m<sup>2</sup>/g), provides a higher morphological selectivity and higher yield. The reactivity of these catalyst particles is maintained even after 24 hours reaction such that yield exceeds 200g carbon per gram of catalyst. The catalysts which are key to the products and yields achieved are prepared to specific parameters (size distribution, composition and crystallinity) specified and via a flame synthesis process as taught in U.S. Patent No. 6,132,653.